



COMPLEX ANALYSIS / STATUE

TASK

Perform structural verification of the one of the highest bronze statue ever built in the Czech Republic.

There was a request for complex analysis including wall thickness design, transport vibration analysis, wind load analysis and seismic analysis.

The exceptionality of this statue is in its high of 25 ft and pedestal high of 16 ft. The picture above shows the 6 ft statue standing at the Stefanik Observatory in Prague which was used as a model.

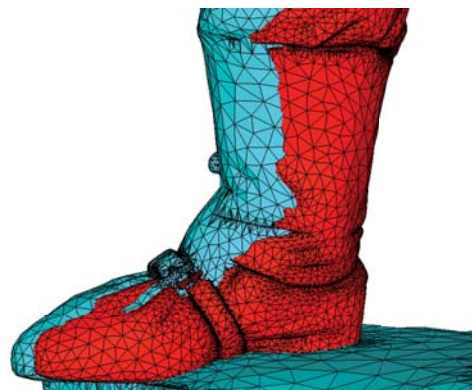
BENEFITS

- The foundry get confidence that their product will not fail during manufacturing, transportation or installation.
- Wall thickness optimization saved about 2200 lbs of expensive bronze.
- LKE experts had been providing consultations during casting, assembling and transporting phase

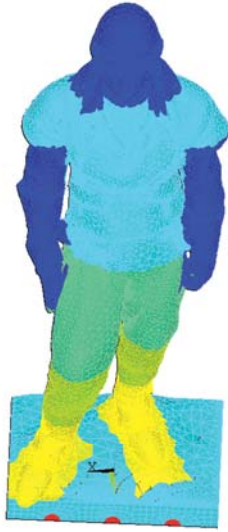
APPROACH

Series of structural analyses which verify structural consistency of the statue. Propose transportation process including transportation cage design. Design of anchoring to the pedestal. EN Eurocode qualification for vibration, seismic and wind load.

Unlike in typical projects, there were no drawings neither 3D CAD model of the statue available. Therefore the only way was to perform 3D scanning of existing 6 ft model. The digitized data were then read in ANSYS program and 3D Finite Element model was generated.

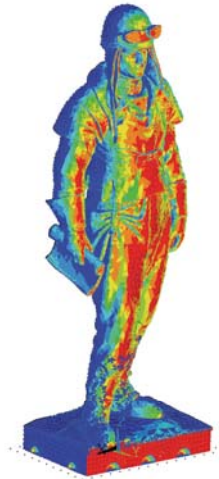


First step included wall thickness optimization and overall design structural verification.

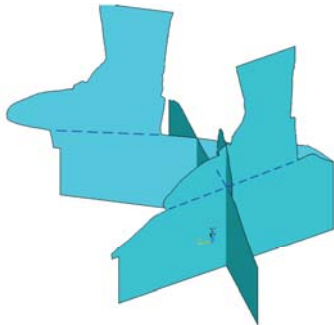


The last series of calculations analyzed loading cases due to external environment at the site.

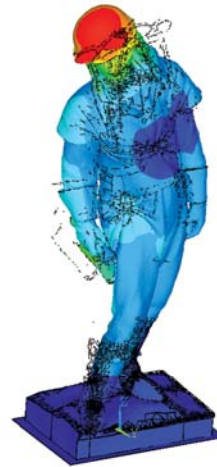
There was a wind load of 110 mph considered in the form of non-uniform external pressure.



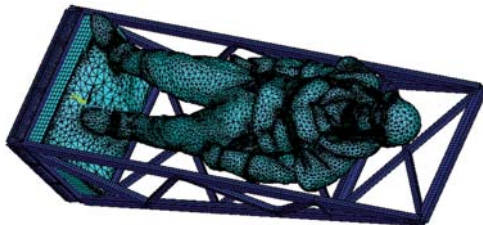
In addition to the thickness of the wall, also the anchoring to the concrete pedestal with reinforcing ribs at bottom part was designed.



The structure was qualified for the seismic loading according to EN Eurocode. Also modal analysis was performed.



In the next step the transporting cage was designed and structurally analyzed for manipulation, transportation and statue installation. This was performed by analyzing several design versions to minimize the cage deformation and unfavorable loading of the statue.



Some locations were redesigned to eliminate high stresses based on dynamic analysis.

RESULT

Performed analyses verified the structural consistency of the design.

The statue has been qualified according to EN Eurocode.

Wall thickness optimization and use of reinforcing ribs reduced the statue weight by 20%.

Then the cage with the statue was analyzed for all loading cases during transportation and installation.

CASE
STUDY

M. R.
STEFANIK